New Plant Records from the Poor Knights Islands.

With special reference to *Todea barbara*.

By L. M. CRANWELL, M.A., Botanist.

Fifteen miles off the North Auckland mainland at Tutukaka lie the Poor Knights, a group of small, high-cliffed, rhyolitic islands of great biological interest. These islands have an irresistable appeal for the botanist, but opportunties for visiting them are rare. Anchorages are poor, and landings, especially on the northern island of Tawhiti Rahi (318 acres), are difficult or impossible except in the calmest weather.

Cockayne in February, 1905, and Oliver in December, 1924, were the first botanists to collect on the group. They made the most of their opportunities for field observation and collecting, describing the salient features of the vegetation of the southern island in particular, which yielded a number of important phytogeographical records, *Xeronema Callistemon,* newly described for New Zealand by Oliver (1926, p. 1) being the most outstanding. They recognised that much was still to be explored, and knowing this they must have left these superbly beautiful islands with great reluctance.

During the visits paid by Miss L. B. Moore, M.Sc., of the Zoology Department of Auckland University College, and the author, attention was concentrated on algal and animal communities between the tide-marks, but several dozen additions to the ferns and flowering plants were made as well as a result of the two trips. These were in November, 1933, with Messrs. A. B. Deeming, R. A. Falla, and A. T. Pycroft, and in February, 1937, with Mrs. A. R. Pickmere and Miss Katie Pickmere, of Whangarei.

Thanks are gratefully offered to the members of the two expeditions, and also to Mr. A. Hereward Pickmere, who made two trips from Whangarei, over fifty miles distant, in February, in his yacht "Arethusa," to land and pick up the party again. In each case the Department of Internal Affairs, in whose care the islands are vested, courteously granted permits for landing.

General descriptions of the Poor Knights will be found in the publications of Bartrum (1936), Cockayne (1905), Fraser (1925), and Oliver (1925). Because of the inaccessibility of these islands, some time must pass before a complete list of their flora can be offered with any confidence. It is the purpose of this paper merely to set down four of the most interesting and suggestive of the new records and to indicate more fully the ecology and mainland distribution of one of them. They are:—

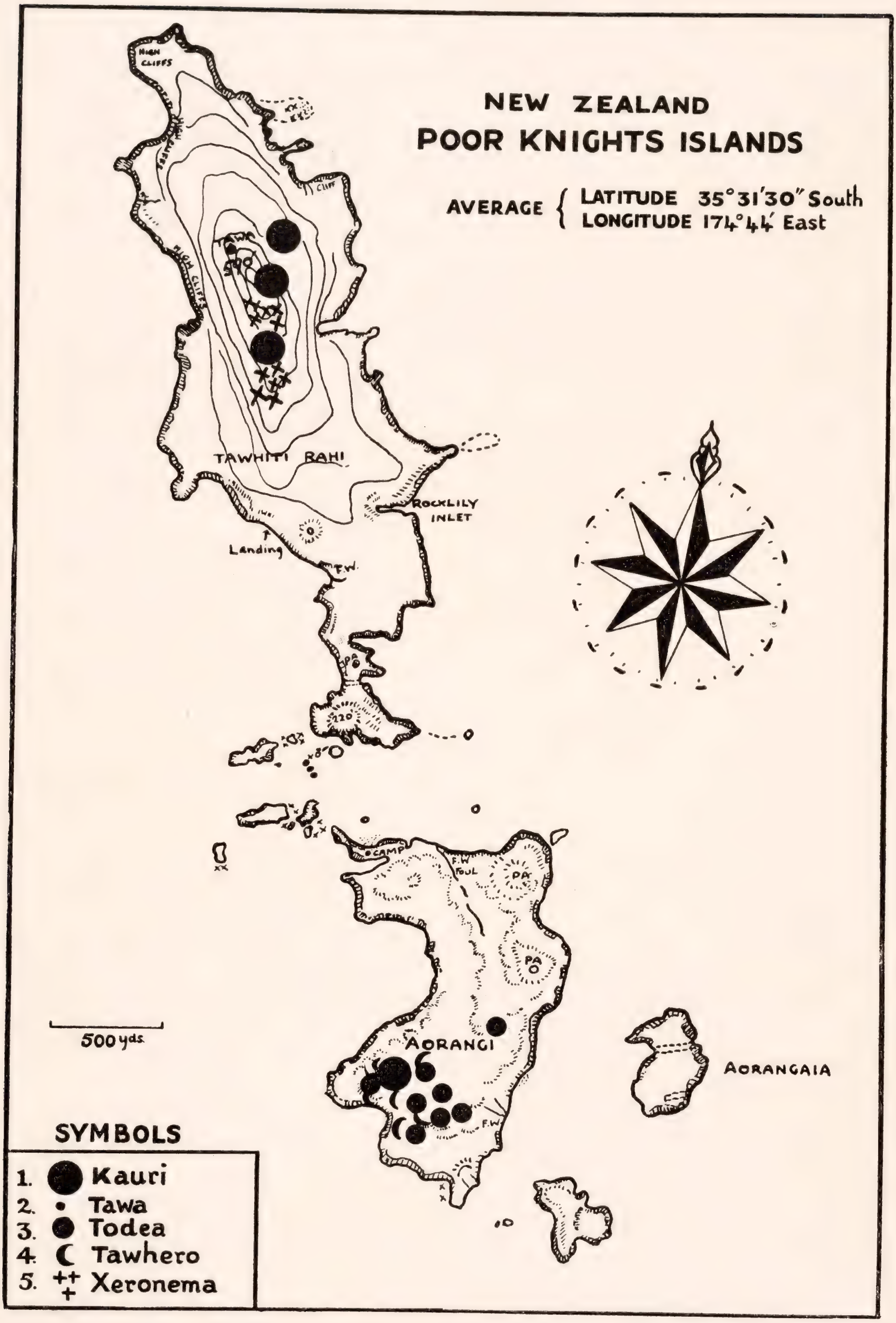

Fig. 1.

Map of Poor Knights from an unpublished Coast Chart compiled from notes made on the Group in December, 1925, by A. H. Pickmere and A. M. Clark-Walker.

[By courtesy of A. H. Pickmere.

For *Xeronema* only the plateau distribution on Tawhiti Rahi is shown.

Todea barbara Moore
Kauri *(Agathis australis* Salisb.)
Tawhero *(Weinmannia sylvicola* Soland.)
Tawa *(Beilschmiedia Tawa* Benth. & Hook. f.)

Of these the first is a large fern not previously found south of Whangaroa, while the other three are forest trees stated by Oliver to be absent from the group.

KAURI, TAWHERO, AND TAWA.

Oliver (1925, p. 380) and Fraser (1926, p. 10) have stressed the importance and wide extent of cultivations, abandoned after the massacre of the Maori owners about the year 1820, and the former suggests that the tall puriri *(Vitex lucens*[*1]), and titoki *(Alectryon excelsum)* on the boulder-strewn fringes of the scrub on the southern island of Aorangi (168 acres) undoubtedly represent the original forest cover.

On both islands there are other areas, neglected by the Maori because of steep slopes or poor soil, where forest seems little disturbed. On the steepest cliffs above the sea this may consist of magnificent pohutukawa *(Metrosideros excelsa* Sol. ex Gaertn. syn. *M. tomentosa)* with a light undergrowth of large-leaved kawakawa *(Macropiper excelsum)*, ngaio *(Myoporum laetum)* and a *Suttonia* (related to *S. divaricata)*; or of pohutukawa mixed with tall karo *(Pittosporum crassifolium)*, more or less *Olea apetala*, parapara *(Pisonia brunoniana*[†]*)*, houpara *(Pseudopanax Lessonii)*, tawapou *(Sideroxylon novo-zelandicum)*, and wharangi *(Melicope ternata)*: in short, a truly maritime type to be matched very nearly on a number of offshore islands and at various places on the mainland coasts.

Kauri, tawhero and tawa bring new evidence of forest of a mainland type which, while salt-tolerating, is more characteristic of warm lowland or lower montane forest in general. On Taranga or Hen Island also kauri occurs (Cranwell and Moore, 1935, p. 308) together with a number of typical kauri forest associates which suggest that larger areas of the interior slopes of this other small isolated island once supported a less maritime vegetation of which the present patches are merely relics, perhaps after sinking of the land mass.

Kauri and Tawhero.

These two species occur together on the highest part of Aorangi, which, according to the unpublished surveys of Mr. A. Hereward Pickmere, is 680 feet above sea level (see map). The few kauri seen were young (Plate 25, fig. 1) and apparently retarded in growth by the low cover of scrubby kanuka *(Leptospermum ericoides)* and pohutukawa on the hungry soil. This locality is more fully described in dealing with *Todea barbara* (see p. 107). Slender, little-branched tawhero push up above this scrub around the kauri while in the tall forest (see p. 107) that grows on the cliffs dropping away immediately to the south, tawhero reaches tree size, and kauri is absent.

[*1] Unless authorities are given in the remainder of the paper they are as in Cheeseman's Manual of the New Zealand Flora: 1925.

[†] Heimerl *(Osterr. bot. Zeitschr.* LXIII, 1913, 279-290) showed that this plant belongs to a genus separate from *Pisonia* and placed it under *Calpidia* Du Petit Thouars, considering that Forster's earlier name *Ceodes* was of uncertain application. Skottsberg *(Meddel. f. Goteb. Bot. Tradg.* II, 1926, 231) showed that the name *Ceodes* was valid, and placed *P. Brunoniana* under it. Later *(Svensk. Bot. Tidskr.* 30, 1936, 738) he discussed the question fully and erected the genus *Heimerlia* for our plant, the correct name of which is thus *Heimerlia Brunoniana* (Endl.) Skottsb.

On Tawhiti Rahi tawhero was not seen. On the summit-plateau two kauri were found while making a hurried traverse from south to north, and a third of fair size was located with its dark pyramidal head showing distinctly above the even-canopied scrub. The first kauri was slender and switchy, and had the appearance of being long suppressed by the pohutukawa scrub-forest, about 12 feet high, through which it would have to push its way to free its crown. Here, as on all the higher ground of the two islands, the soil, composed of rotten rhyolite, often in loose boulders, was very poor, dry, and inhospitable. The floor cover was composed almost entirely of tall dense tussocks of *Astelia Banksii,* almost impenetrable when associated with the rigid sprawling branches of pohutukawa. Of low shrubs, *Senecio Kirkii* and the *Suttonia* were commonest; *Asplenium lucidum, Asplenium flaccidum* and *Polypodium diversifolium* occurred on the floor. The *Astelia* did not dominate the undergrowth over all the plateau on Tawhiti Rahi. In some places under the pohutukawa, or especially under *Leptospermum,* mature plants of which leave the soil more open to sun and wind, *Xeronema Callistemon* covered the ground for several square chains at a time (Plate 26, fig. 2). Seedlings were growing in abundance in thin surface litter on the margins of these colonies, or in gaps within them. As *Xeronema* was considered to be confined to the precarious cliff-habitat (Plate 26, fig. 1) which has made it familiar to visitors to the Poor Knights (Oliver, 1925 and 1926) and to Taranga (Cranwell, 1933, p. 234, and Cranwell and Moore, 1935, p. 302) it was interesting to observe the height, the dark healthy green colour and the profusion of leaves in a setting so different from any in which it had previously been found. Apparently the soil conditions that here stunt all forest trees are perfectly suited to *Xeronema.* The abundance of old flowering scapes suggested that these areas must be a remarkable sight in late spring and early summer, when the coral-red flowers appear.

The second kauri (Plate 25, fig. 2) lay beyond the *Xeronema,* surrounded by rather taller pohutukawa with the *Astelia* undergrowth in possession again. The bracken-fern *(Pteridium esculentum)* occurred here also. This kauri is youthful, but it has probably been of very slow growth, especially in the initial stages, which may even have been passed during the time of Maori occupation. The third tree, already mentioned, lay to the north of this on lower slopes, for which time and the consideration of a rising sea did not permit a visit.

Tawa.

Beyond this scrub, towards the north-western extremity of the island, grew patches of forest whose species-content and fine growth indicated a change in soil. The ground was a jumbled mass of boulders of all sizes, with pockets of humus between. Bigger rocks were dominated by very large pohutukawa, whose branches obscured the view in most directions. Amongst the boulders rose tall, heavy-trunked houhere *(Hoheria populnea)*, kohekohe *(Dysoxylum spectabile)*, mahoe *(Melicytus ramiflorus)*, mangaeo *(Litsaea calicaris)*, parapara *(Pisonia Brunoniana)*, pigeonwood *(Hedycarya arborea)*, tawapou *(Sideroxylon novo-zelandicum)*, wharangi *(Melicope ternata)*, and whau *(Entelea aborescens)* in natural clearings. One tree, with a crown of recurved leaves very similar in the distance to those of pohutukawa, proved difficult to locate from the forest-floor because of the strange dissimilarity between exposed and shade leaves. This was tawa, and an extreme example of the broad-leaved form found here and there along the coasts from Bay of Islands to Coromandel, on the Little Barrier Island (specimens in Cheeseman Herbarium) and on Hen Island (Cranwell and Moore, 1935, p. 311). This form is usually found where tawa and taraire *(Beilschmiedia Tarairi)* are associated near the sea, so that the possibility of hybrid origin cannot be overlooked. Taraire, as far as we know, is not now present on the Poor Knights.

In trunk, bark, inflorescence, and manner of emergence of long shoots from near the base the tree agrees with "normal" tawa. The great difference lies in these shade trees, which may easily be confused from below with those of mangaeo. The largest measured were much larger, however, as they were seven inches long (excluding petiole), and four inches across. This extreme size may be partly epharmonic as many species develop large leaves on some of the coastal islands, and nowhere more markedly than on the Poor Knights, especially where the warm light soil is heavily manured by burrowing birds.

Naturally the status of this *Beilschmiedia* will not be clear until the evidence from a number of localities can be sifted.

TODEA BARBARA, ON THE POOR KNIGHTS.

The Osmundaceae are represented in New Zealand by two genera—*Todea*, with one species, and *Leptopteris*, very closely related, with two, *L. hymenophyoides* and *L. superba*, both large and beautiful ferns of membranous texture and pellucid tones. Of these the two Leptopteris are endemic and widely distributed in moist forests, while *Todea*, which is monotypic, is found only sparingly in New Zealand: it is indigenous to South Africa and parts of Australia as well.

Cheeseman (1925, p. 90) gives the following localities for *Todea barbara*: "Abundant in open gullies from the North Cape to Mangonui, and from thence more sparingly southwards to Whangaroa." See map (fig. 2).

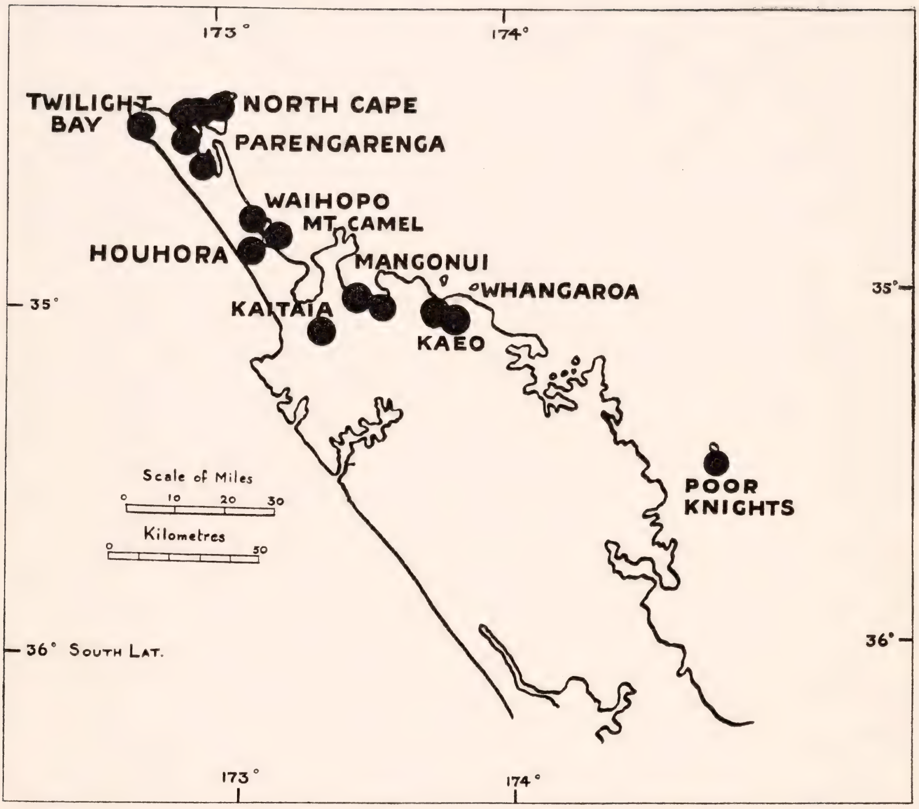

Fig. 2.

Distribution of *Todea barbara* Moore in New Zealand. This map, showing the chief localities for *Todea*, has been compiled chiefly from collections in the herbaria of the Dominion Museum, Wellington, the Canterbury Museum, Christchurch, and the Auckland Museum, Auckland.

It was therefore a pleasant surprise to find the species in comparative abundance on Aorangi, some 60 miles south of Whangaroa. The discovery was made in February, 1937, and on our first climb to the high southerly plateau, on which the trig. station was once erected.

The first specimen (Plate 25, fig. 3), a large and elegantly proportioned plant with pale green fronds coming from near ground-level, was sighted by Miss Moore as we climbed on to a tree-shaded knoll in search of a lookout. Below lay the main valley, walled in by high flanks that drop away 200-300 feet to the sea on the east and west. Throughout this fertile part, the site of the old Ngatiwai cultivations already mentioned, the ground was very bare. The growth of more than a century was a curious, low, tight scrub of *Suttonia divaricata, Dysoxylum spectabile, Edwardsia microphylla, Hedycarya arborea, Macropiper excelsum* (large form), and *Melicope ternata*, with occasional short thick-trunked *Pisonia brunoniana* and striking groups of *Cordyline australis* surrounded by their dry litter of long leaves.

Few soft ferns were seen because of the depredations of pigs, which had routed landsnails and burrowing birds (but not all the ground-birds, e.g. rail) as well, and which in their turn were exterminated only last October by Captain G. F. Yerex, of the Department of Internal Affairs. There were no signs even of uprooted bases of *Todea*, and it is improbable that the gloom under the matted branches and large foliage would suit them there now, whatever the original conditions had been.

On the knoll itself grew tall pohutukawa, throwing out great limbs above the blocks of dry rhyolitic rock in which they were rooted, and it was on the sheltered but rather sunny slopes packed with rock debris and fine humus that *Todea* grew, here and there, in luxuriant condition. Associated with it in the undergrowth was *Blechnum membranaceum*, seedling *Corynocarpus laevigatus*, *Macropiper excelsum*, *Melicytus ramiflorus*, *Pseudopanax Lessonii*, *Pteris macilenta* and *Suttonia divaricata*.

Higher up on the island stands of tall kanuka and medium-sized pohutukawa were met, usually trailing lianes of *Clematis parvifolia* and *Parsonsia heterophylla*, and with a sparse undergrowth of *Corokia Cotoneaster*, *Oplismenus undulatifolius*, *Microlaena polynoda*, *Muehlenbeckia complexa* and *Wahlenbergia gracilis*.

With the appearance of broken, greyish-white, crumbly boulders, which are strewn over the whole surface of the ground, *Todea* again comes in. Little or no soil is to be seen here. On this poor rock, exposed to strong winds and sunlight, all plants are dwarfed, so that *Todea barbara* in its compact, narrow, harsh, and yellowish sun-form 2-3 feet high, is often as tall as the scrub of dry, open, gnarled pohutukawa, smothered with *Metrosideros perforata* (Forst.) Rich. syn. *M. scandens*, in which occurs abundant *Leptospermum ericoides*—a form with soft, small-leaved foliage and very small flowers, a little *Agathis australis*, *Dendrobium Cunninghamii*, *Earina mucronata*, *Hebe salicifolia*, *Leptospermum scoparium*, *Muehlenbeckia complexa*, *Oplismenus undulatifolius* rigid *Suttonia*, *Weinmannia sylvicola*, *Wahlenbergia gracilis*, and the pteridophytes *Cyclophorus serpens*, *Doodia media*, *Hymenophyllum* spp., *Lycopodium Billadieri* and *L. volubile*, *Pellaea rotundifolia*, *Schizaea fistulosa*, a surprising amount of *Trichomanes reniforme*, reminiscent of damper pohutukawa scrub on the lava of Rangitoto Island.

On the steep shaded slopes that form the southern end of the island, there grows a forest of tall pohutukawa, with an abundance of *Dysoxylum spectabile*, *Hoheria populnea*, *Leptospermum ericoides*, *Litsea calicaris*, *Melicope ternata*, *Pseudopanax Lessonii*, *Sideroxylon novo-zelandicum*, *Weinmannia*, and smaller amounts of *Hymenanthera novae-zelandiae* and *Olea apetala*. Small groups of *Dicksonia squarrosa* (many dead, as on other parts of the island), *Polystichum Richardi* and tall *Suttonia* grow in the middle layers. Vast quantities of *Xeronema Callistemon* are lodged on rock-tops and pohutukawa bases. *Todea* here was very tall, and very abundant. On the excessively dry and broken rock sloping from the summit to the south-eastern corner opposite Aorangaia or Falla Rock, *Todea* was again plentiful in sun-baked, heavy clumps, together with some *Xeronema* among the sprawling pohutukawa.

Todea is thus rather widely spread on Aorangi, especially on the cap of rotten rhyolite unfavourable to most species. We looked for it without success in rather similar situations amongst the less dwarfed pohutukawa on the continuation of the plateau at the northern end of Tawhiti Rahi. It may have been missed, however, in the lowest scrub, presumably on the poorest soil, at the north-eastern limits of this rugged island.

Description of the Species.

As *Todea barbara* is so little known in New Zealand, especially in the wild state, the following brief description is given: The rhizome is often thick, deeply rooted and heavy, giving off a number of fronds with stout glabrous stipes two or more feet long, topped by fronds one to four feet long in New Zealand, but stated to reach a length of more than eight feet, including stipe, in Australia. They are twice pinnate, 9-12in. broad, with numerous narrow-lanceolate primary pinnae 4-12in. long and ½-2in. broad, the pinnules ½-2in. long and 1/6-¼in. wide, dark to yellowish green, coriaceous, and quite glabrous. The sori are usually massed in profusion over almost the whole of the undersurface of the pinnules of the lower pinnae. The upper parts of the frond are sterile.

In New Zealand, and particularly on the Poor Knights, *Todea barbara* does not reach anything like the dimensions recorded for some Australian specimens. Hooker (1860, p. 153) speaks of it as "a noble fern with a caudex at times 5 feet high and 6 feet 9 inches circumference; fronds sometimes 8½ feet long." Smith (1875) described a specimen from the Victorian Alps 5 ft. 8 in. in height, 7 ft. 9 in. diameter, with a weight of 1 ton 3 cwt. He mentions a specimen received at Kew bearing 30 crowns and 160 fronds. Numerous plants were sent to Europe by F. von Mueller, one of which had a trunk "1.76m. high, 1m. thick, and 2.5m. broad." Seward and Ford (1903, p. 239) give the measurements of a plant in the Cambridge Botanic Gardens as: circumference 8 ft., height 3 ft., distimet crowns 14, "bearing 230 fronds, with an average length of 7 ft. 6 in." Equally magnificent specimens are mentioned for South Africa. It may be, and certain differences in the pinnules also suggest this, that more than one species is included under the name.

Bentham (1878) gives the Australian records: Queensland, N.S. Wales, Victoria (Grampians), and "Tasmania. Abundant in the Yorktown rivulet, scarce elsewhere, Gunn; Recherche Bay, Oldfield." Black (1922) records it for the gullies on the Mount Lofty Range (South Australia), and gives the dimensions as: "trunk often more than 1m. high, leaves to 2m. long." In South Africa it is recorded from the Cape to the Drakensburg Mountains.

Mainland Localities of Todea.

The Poor Knights plants agree with those on the northern mainland in demanding strong insolation. This condition is usually to be obtained on poor soils, unfavourable to tree-growth, of which there are a number of types in the Far North.

Cheeseman (1898, p. 352) for instance, writes of his route near the source of the Ngatikorangi stream (near Te Paki) on the edge of *Pomaderris Edgerleyi* scrub—"Here the consolidated sandhills contained numerous funnel-shaped holes from 12-15 feet in depth, their sides covered with a profusion of *Gleichenia flabellata, Todea barbara,* and *Doodia media.*" At the head of Houhora Harbour, on open kauri-gum land "many of the gullies contained large clumps of *Todea barbara,* its erect, rigid habit and massive mode of growth making it easy of recognition from a distance. It was often associated with *Gleichenia flabellata,* to which it offered a most striking contrast."

In addition to the localities expressly quoted by Cheeseman there are a number of others between Whangaroa and North Cape in the herbaria of the Dominion Museum, Wellington, of the Canterbury Museum, Christchurch, and of the Auckland Museum, representing collections made by H. Carse, T. F. Cheeseman, H. Hamilton, T. Kirk, H. B. Matthews, R. H. Matthews, W. R. B. Oliver, and D. Petrie. The accompanying map (fig. 2) has been drawn up from these various collections. Thanks are offered to Dr. Oliver, and to Mr. R. A. Falla, directors of the Dominion Museum and the Canterbury Museum respectively, for making this information available. Hooker (1864, p. 384) gives records for "Mount Carmel" (Jolliffe) and for Hokianga (Mrs. Jones). The plant has not since been reported in the west. Correspondence with small crested fronds forwarded by Mr. A. E. Aldis to Mr. Cheeseman refer to the parent plant in a garden in Kaitaia, but does not state its exact source. Mr. McKinnon reports that the fern does not now occur near Kaitaia, but Carse and the Matthews found it near there. Carse also found it on landslips between Kaitaia and Mangonui.

In striking contrast to most of our native plants, *Todea* recovers rapidly after burning, and is quite as stubborn as the scrub in which it grows. This is undoubtedly due to its large, deeply-seated rhizome, thickly mantled with brown adventitious rootlets, and to its love for exposed positions. Captain E. J. Keatley, of Mt. Albert, and Mr. L. H. Millener, B.Sc., of Auckland University College, report that *Todea* still occurs in great abundance north of Te Hapua, where Cheeseman collected it (remarking on the repeated burnings even then), and Captain Keatley has himself observed its condition before and after burning in a number of localities between Kaeo, south of Whangaroa, and Spirits Bay.

Although dry open ground is favoured by the fern in New Zealand, it is to be noted that French (1937) remarks with surprise on a fairly dry habitat in the Grampian Mountains—"I was shown a fine lot of young King Ferns *(Todea barbara)* growing between rocks and a fair distance from water. I had never seen these ferns away from running water or swamps before."

Conclusion.

The presence of kauri, tawhero and tawa, especially the broad-leaved form, add further interest to this phytogeographically important group. The splendid natural gardens of *Xeronema* in an unexpected and charming habitat, and the occurrence in its southernmost home of that dramatic link with Mesozoic times, *Todea barbara*—a plant that caused Christ (1910, p. 259) to exclaim: "*Imposant und einsam ist der Reise Todea barbara, ein knolliges Rhizom, eisenfest und von Zentnerschwere, dem die derben grossen Wedel in Büscheln entspringen, mit dem hochst archaistischen Zuge (wie die Thyrsopteris), dass nur die untersten Fiedern fertil sind: eine Osmundacee, eine Welwitschia unter den Farnen*"—also enhance the claims of the Poor Knights to be guarded as a sanctuary sacrosanct.

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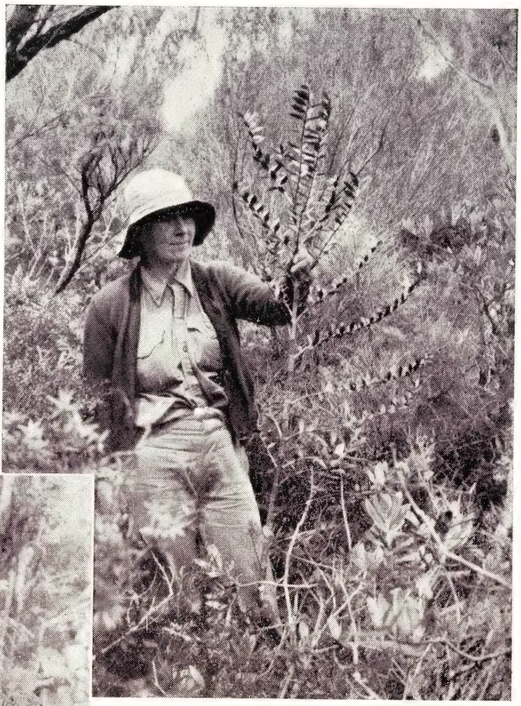
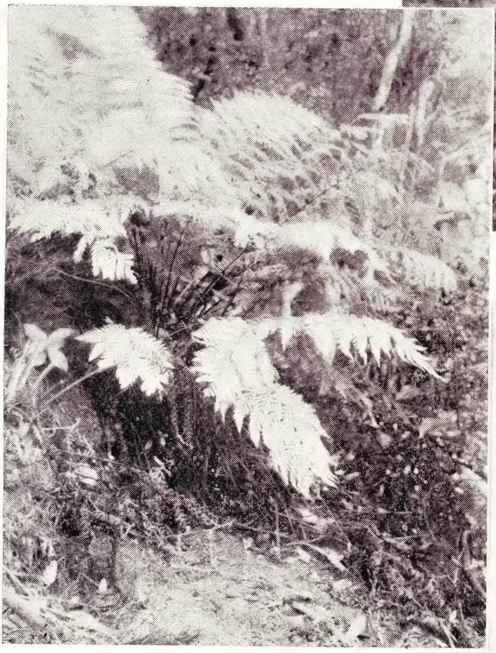
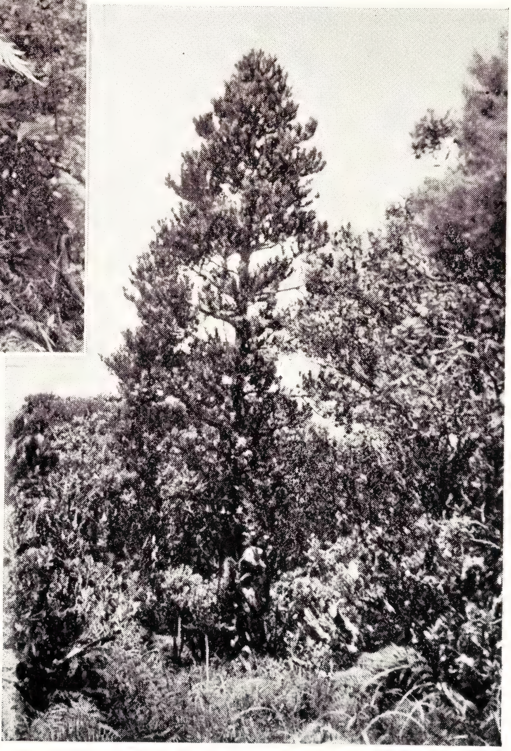


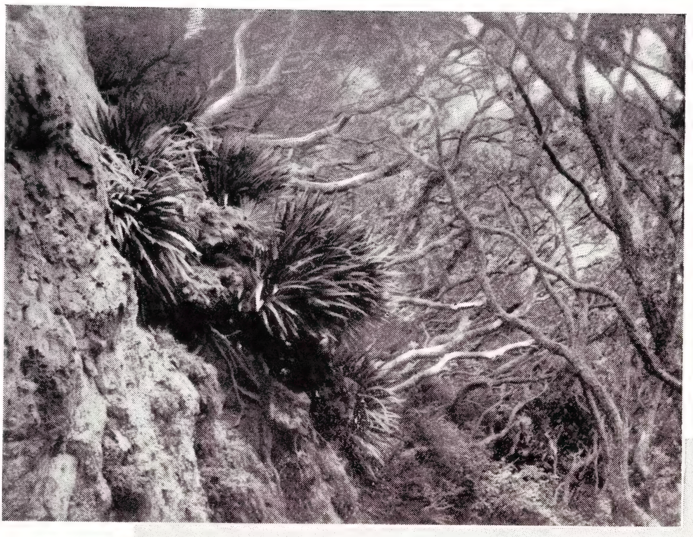
Young kauri near summit of Aorangi.



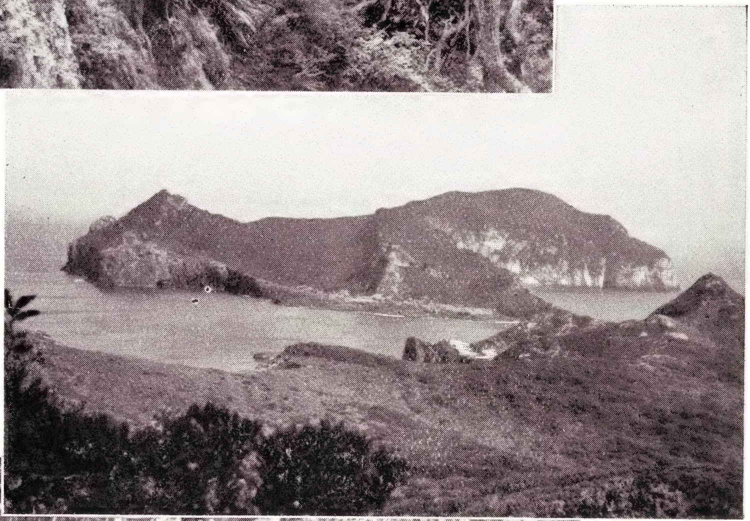
Todea barbara in dry forest: Aorangi.



Kauri in pohutukawa scrub-forest, Tawhiti Rahi.



Masses of *Xeronema* hanging out from a cliff-face: Aorangi.



A view of Aorangi from the northern island.

Dense undergrowth on the plateau: Tawhiti Rahi.